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A REPORT ON HEVEA DISEASES IN PERU

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The period April 30 to May 21 was spent in Peru in company with Mr. William Mackinnon, Plantation Management Adviser. The Hevea plantings on Yurac Plantation, the Tingo Maria Experimental Station, and two private farms in the Tingo Maria area were inspected. Since Mr. Mackinnon's report will deal with agronomic and economic phases of the rubber program in Peru, the writer's report is confined to a discussion of diseases and their control.

An explanation should precede the recommendations made in this report. Although many publications and text books based on plantation practices in the Far East recommend control measures against practically all diseases of Hevea, research and experience on the Western Hemisphere Rubber Program have shown that a number of these recommended treatments are not necessary. In some cases, excision of bark bursts and patch cankers, for example, detrimental effects have resulted from them. The major objective of this report, therefore, is to differentiate between the diseases that require control measures and those that do not. In some cases the later are just as conspicuous as the former.

For convenience, the diseases occurring in nurseries are considered apart from those of field plantings. Although they are caused by the same organisms in many cases, control measures which are practiced in the nurseries usually are not applicable to field plantings.

Diseases Occurring in Hevea Nurseries

At both Tingo Maria and Yurac, target leaf spot caused by Pellicularia filamentosa, continues to be the major nursery disease. South American leaf blight, caused by Dothidella ulei, is a relatively minor problem. Excellent control of both of these diseases is being obtained by spraying with Dithane (Z-78). No change in current nursery spraying practices is recommended.

Dithane has been extensively tested since 1950 and has proved greatly superior to the copper fungicides for control of leaf blight. It also effectively controls Phytophthora die-back and does not inhibit the growth of Hevea as do frequent or concentrated applications of copper fungicides. With the striking demonstration of its effectiveness in controlling Pellicularia in Peru during the past year, this fungicide, or Parzate, which is the same in chemical composition and effectiveness, should be used for all nursery spraying.

Another nursery disease on which control measures have proved effective at both Tingo Maria and Yurac is infection of bud patches by Diplodia theobromae or other fungi. Ing. Watson estimates that the Fermate treatment developed by Dr. Gorenz has given a 20 to 30% increase in budding takes. This treatment should, of course, be continued in all nursery budding work in Peru.

A large percentage of the plants in one corner of the Tingo Maria nursery had been killed by root disease. In the absence of fruiting bodies of the fungus, the disease was tentatively identified as Brown Root disease caused by Fomes noxius. No control other than the isolation trench which had already been dug around the infection center is recommended. This area of the nursery should not be again planted to Hevea for at least two or three years.

Black crust, caused by Catacauma huberi, was rather abundant on some nursery plants at both Tingo Maria and Yurac, especially the latter. No special control measures are required against this disease.

Diseases Occurring in Field Plantings of Hevea

Target Leaf Spot (Pellicularia filamentosa) -- Target leaf spot is the most serious disease of plantation rubber in Peru. On Yurac Plantation it has caused retarded growth and loss of many newly transplanted trees. Damage to trees top-budded with FB-3363 has been relatively light. Ing. Watson is of the opinion that, despite attacks of Pellicularia, trees top-budded with FB-3363 makes satisfactory growth at Yurac, and the entire supplying program is now based on this clone. The writer's observations at both Tingo Maria and Yurac indicated a higher degree of tolerance to Pellicularia by FB-3363 than by any of the other Ford clones which have been used as tops.

In the long run, use of a single top clone for a large area of Hevea greatly increases the chances of build-up of specialized strains of disease organisms. The most urgent new disease control measure required in Peru, therefore, is selection of additional clones having desirable crown characteristics and tolerance to Pellicularia.

In the absence of high resistance to Pellicularia among any of the blight-resistant clones with known growth and crown characters which are established in the Pellicularia test plot at Tingo Maria, a search for clones with tolerance comparable to that of FB-3363 was made. The following clones were selected:

Clone	Origin	Foliage Retained Oct.-May* (%)
F-4542	Jungle selection	Almost 100
FX-652	Progeny of F-4542 x TJ-1	95
FX-645	" " " " " "	90
FX-469	" " " " " "	90

* The rainy season.

Nine-year-old trees of the above clones have shown good growth and satisfactory crown characters at Belterra, Brazil. FB-3363 growing in the same plot with these clones retained approximately 95% of its foliage. The most susceptible clones in the plot retained approximately 50% of their foliage.

It was recommended that the Ford clones listed in the preceding table be budded in an unsprayed nursery plot at Yurac to the extent of 100 or 150 buddings of each clone. Fifteen or 20 buddings of FB-3363 should be included as a control. Any of these clones which show tolerance to Pellicularia and growth comparable to that of FB-3363 after being tested for eight or ten months should be used in a mixture with FB-3363 for further top-budding work in Peru.

A group of 22 hybrid clones which was selected at Belterra by Dr. Rands in 1951 and is now being tested for resistance to leaf blight at Turrialba should be established in Peru and tested for tolerance to Pellicularia as soon as possible. These clones include the best top-budding material from thousands of blight-resistant, cross-pollination progenies at Belterra, and it is likely that some of them will prove superior to the top-budding clones now available in Peru. It should be emphasized, however, that no new clones should be introduced into the top-budding program without first being tested in an unsprayed nursery plot in the area where they are to be used. Those lacking tolerance to Pellicularia or a satisfactory growth rate should be eliminated. This will avoid further use of such clones as IAN-486 and FX-2261 which showed promise in Costa Rica but are extremely susceptible to Pellicularia in Peru.

YURAC PLANTATION has been more heavily damaged by Pellicularia than any other Hevea planting yet seen by the writer. The older trees on the plantation have now reached the stage at which they acquire a high percentage of their foliage during the relatively dry weather of the annual leaf-change period. This foliage is not seriously damaged by Pellicularia; therefore, the trees are making satisfactory growth in spite of the loss of a large percentage of the leaves which emerge on growing shoots during the wettest months of the year. However, extreme difficulties encountered in attaining satisfactory development of young trees of highly-susceptible clones at Yurac, make it essential that Pellicularia-tolerant clones be used for further top-budding work there.

At TINGO MARIA damage to field test plots during the past year has been much less than at Yurac. It was comparable to the limited damage which occurs during the rainy season of each year in extensive Hevea plantings of the lower Amazon Valley and does not present a serious obstacle to the development of economic plantings of rubber.

At HACIENDA LAS DELICIAS (property of Sr. Tong) Pellicularia could not be found in a young Hevea planting of several hectares. This planting is located at a distance of 30 kilometers from Tingo Maria and at an elevation of approximately 3,000 feet. The most likely explanation for the absence of Pellicularia is the excellent air drainage and the relatively infrequent occurrence of fog.

Although climatic conditions are much more favorable for development of Pellicularia in some localities than in others, the use of Pellicularia-tolerant clones for future top-budding work in all rubber-growing areas of Peru is recommended.

South American Leaf Blight (Dothidella Ulei). -- All of the top-budding clones used in the Hevea plantings that were inspected have shown immunity or high resistance to leaf blight. No additional control measures are required against this disease.

Phytophthora Die-Back (Phytophthora palmivora) -- Mummied seed pods hanging in some of the trees at Tingo Maria would indicate that Phytophthora was active during the height of the rainy season this year. In the older and denser plantings, the lower branches on many trees were dead. This was probably caused by a combination of Phytophthora and normal abscission, the latter being accelerated by dense shade. Only an occasional topmost branch or shoot was dead.

The condition described above is comparable to that which has occurred at Belterra and elsewhere in plantings approaching maturity. Damage to the trees at Tingo Maria has not been serious and would not be appreciably lessened by pruning out the dead branches. No attempt to control this branch die-back is recommended.

Black Crust (Catacauma huberi) -- Black crust was the most generally distributed and conspicuous disease seen by the writer in Peru. This condition can be attributed largely to the following facts: (1) Leaves that are heavily attacked by target spot or leaf blight promptly fall carrying with them the evidence of the cause of defoliation, and (2) practically all leaves attacked by black crust remain on the tree until advent of the annual leaf change period.

Black crust lesions develop very slowly, and seldom, if ever, become visible until the leaves are a month old. Defoliation is rare and most necrosis associated with the lesions is caused by secondary invaders such as Glomerella cingulata which become very active during the latter part of the rainy season.

Observations in Brazil since 1944 have shown that there is little or no correlation between heavy infection by black crust and retarded growth of nursery plants. This same situation prevailed in Peru during May, 1952. It was also noted that the Hevea planting on Hacienda Las Delicias, which was very heavily attacked by black crust but practically free of other diseases, has made excellent growth.

It is considered extremely unlikely that damage from black crust will be serious enough to appreciably impede development of economic rubber plantations in Peru.

Avoidance of extremely susceptible clones is the only control measure recommended against black crust. Among several thousand selections made in Brazil, approximately one dozen have been eliminated because of extreme susceptibility to black crust.

Pink Disease (Corticium salmonicolor) -- No active cases of pink disease were found at either Tingo Maria or Yurac. This disease, however, has occurred and caused some concern in the past.

Observations in the Entre Rios area of Guatemala, which has had the highest incidence of pink disease yet noted in the Western Hemisphere (an estimated 2 percent) have shown that most attacked trees recover without treatment. However, use of a good fungicide and sticker (or one of the coal tar preparations) to paint over sporulating areas on trees occurring in infection centers (spots where the incidence of disease is high) is recommended. This should inhibit spore dissemination.

Excision and burning of all diseased parts of the tree as practiced on some Eastern plantations is not recommended. Damage caused by this treatment usually exceeds that caused by untreated cases of the disease.

Root Disease -- Tap root cankers, together with latex ooze and formation of rubber pads, have occurred at Yurac Plantation for at least three years. The cause of this condition has not been determined but the symptoms are very similar to those caused by a combination of wind torsion and attacks of fungi (largely Phytophthora palmivora and Fusarium spp.) on the trunks of trees on the Goodyear Plantation at Cairo, Costa Rica. Only an occasional tree has been lost at either Cairo or Yurac. At the latter place the trouble has been largely confined to areas having a high water table.

Regardless of the exact cause of root cankers at Yurac, only one treatment can be recommended against them. It is improved drainage to lower the water table in wet spots. This has already been accomplished to a large extent, and there are indications that the trouble is decreasing. Many cankers which had callused over were noted.

The chances of halting the advance or hastening the healing of root cankers by excavating and treating the roots with fungicides are nil. Treatment of the easily accessible trunk cankers on the Goodyear Plantation has proved detrimental rather than beneficial. Therefore, no treatment of this nature is recommended for root or trunk cankers.

Panel Diseases -- The cause of a panel disease which has occurred during wet weather at Tingo Maria could not be ascertained on the basis of the few inactive specimens available. However, it is safe to assume that the disease is caused by Phytophthora palmivora or Ceratostomella fimbriata. In some localities both of these fungi occur in the same plantings and on the same panels. A common treatment will suffice to control both of them.

The rubber technicians at both Tingo Maria and Yurac stated that panel infections have been prevented by applying Fermate (Ferric dimethyl dithiocarbamate) during the rainy season. Although iron is one of the tree metals (copper, manganese, iron) which we have been advised may act as catalysts in oxidizing the rubber molecule, it would appear that no damage has been done by Fermate with the possible exception of making the smoked sheets slightly tacky. However, since traces of these metals may have a deleterious effect on valcanized rubber products, the use of fungicides that contain them should be avoided.

No panel treatment is recommended during the relatively dry weather which prevails from June to October or November. Prior to October, a panel treatment for use during the rainy season will be recommended on the basis of results now being obtained at Cairo and Turrialba, Costa Rica. In the meantime a supply of Socony-Vacuum Product E.P. -487.2 should be obtained for tests involving several hundred trees growing under Yurac conditions.

Felt Disease (Septobasidium spp.) -- The common occurrence of cases of felt disease on Yurac Plantation was pointed out by Ing. Dieguez. This was the first time that the writer has seen this disease on Hevea trees. Its attack was confined to secondary branches (usually the forks) and damage was very limited. No control measures against this disease are recommended.

Sun Scorch Followed by Fungus Invasion -- Numerous cases of sun scorch followed by fungus invasion were noted at Yurac. This results in a dead patch of bark which usually extends from near the ground line for a distance of six inches or a foot up the tree trunk. It usually extends $\frac{1}{4}$ or 1/3 the distance around the trunk and tapers to a point at the top.

Although various semi-parasitic fungi may be responsible for the actual bark decay, the fact that sun scorch is the predisposing and primary factor in these cases is borne out by the almost universal occurrence of the dead patches on the northwest side of trees at Yurac (Southern Hemisphere); the southwest side of the trees in Central America (Northern Hemisphere); and on the due-west side of trees at Belem and Belterra (almost on the equator).

Except in the case of new transplants, vigorous trees are seldom seriously damaged by sun scorch. No control measures are required against it in established field areas. The wounds callus over after shade is restored.

Trunk Cavities and Pruning Wounds -- When a large tree is rebudded and cut off, a cavity caused by decay of the central portion of the old trunk often extends well below the new bud patch. Water may collect in this cavity during the rainy season.

The experience involving approximately two million trees in Brazil and Costa Rica has been that no permanent damage results from these cavities. Filling them with cement or other materials, therefore, accomplishes no useful purpose. Likewise, disinfecting these and other pruning wounds to prevent formation of cavities is unnecessary and usually unsuccessful.

Materials Needed for Recommended Disease Control Program

Materials needed to carry out the disease control measures recommended in this report are listed below. Sources of supply and approximate amounts required are indicated. In some cases the materials are obtainable from distributors in Peru.

1. Dithane (Z-78) or Parzate (dry) -- used for control of foliage diseases in nurseries. Annual consumption should be approximately 300 pounds for each acre of nursery. Manufactured by:

Dithane - Rohm & Haas Co., Washington Square, Philadelphia, Pa., U.S.A.
Parzate - E.I. du Pont Co., Wilmington, Delaware, U.S.A.

II. Fermate - Used for prevention of budpatch infection. Manufactured by E. I. du Pont Co., Wilmington, Delaware, U.S.A.

III. Calcium Caseinate or "Triton B-1956" - used to improve spreading and sticking properties of spray mixtures. Annual consumption of calcium caseinate should be approximately 200 pounds for each acre of nursery; consumption of "Triton B-1956" approximately 3 gallons. Manufactured by:

Calcium Caseinate - Various milk canning companies
"Triton B-1956" - Rohm & Haas Co., Washington Sq.,Phila.,Pa., U.S.A.

IV. Socony Vacuum Product E.F.-487.2 -- for use in preventing tapping panel infections. Apply to tapping cut only. Consumption may run around 1 pound per tree annually. To obtain, contact the Socony Vacuum Oil Co., Shoreham Bldg., Washington, D. C.

V. The 22 clones mentioned on page 3 in this report should be obtained at the earliest possible date from the U.S.D.A. Rubber Station at Turrialba and tested for tolerance to target spot at Tingo Maria and Yurac. Additional clones combining vigor, good crown characteristics, and tolerance to Pellicularia will represent the most valuable contribution toward disease control that can be made on the rubber program in Peru at the present time.

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